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Atmospheric Chemistry and Physics Discussions

Interactive comment on "The ASSET intercomparison of stratosphere and lower mesosphere humidity analyses" *by* H. E. Thornton et al.

H. E. Thornton et al.

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We thank Referee 2 for their comments. Please find below detailed comments on how we propose to address them.

We agree with the referee that it would have been very interesting to have compared the analyses over a longer period. Unfortunately the comparison was not initially envisaged when the experiments were set up and consequently only 1 month of data was available across the different centres. Attempts will be made to improve the readability of figures 5 and 6. The start dates for which the different centres runs were made will be included in the paper. Spin up is not belived to be an issue as there were at least 10 days of assimilation of MIPAS data prior to the comparison period. Any spin up period, was

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found to be shorter than 2 weeks. The following comment will be added into the paper after the end of section 4.

'All the experiments commenced at least 10 days prior to the start of the intercomparison period (the 18th Aug, 15th Aug, July 2002 and 4th Aug for the ECMWF, MIMOSA, BASCOE and Met Office analyses respectively). The intercomparison period was chosen such that any spin up issues were resolved prior to the start of the intercomparison period.'

Specific comments:

1) The paper has now been published by ACP, the caveat will therefore be removed.

2) In the BASCOE scheme, water vapour is a control variable, therefore assuming the MIPAS data pass the quality control process, the biases in the background field can be improved. However, parameters of the PSC scheme like the surface area density of the NAT, STS or Ice particles are not control variables and, therefore any biases in these parameters can influence the water vapour field. To clarify the following addition will be made:

Line 25 pg 13514: after '2008).' add:

'Water vapour is a control variable in the BASCOE 4D-VAR system and the background errors are diagonal....'.

3) The typing error will be corrected.

4) A table (Table 1) summarising the MIPAS observation rejection statistics by the quality control schemes has now been included. The following text will also be added:

pg 13523, line 6 after 'the lower mesophere.' add:

'Rejection statistics for the MIPAS retrievals for the different assimilation systems are summarised in Table 1. For the ECMWF and the BASCOE system, observations are rejected from the assimilation if they deviate too much from the model background

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field, in order to remove outliers. No such quality control is included by MIMOSA. Higher rejection rates occur over the South Polar region and the Tropics for at least one assimilation system, and these regions are shown separately in Table 1. Elsewhere, rejections are typically less than 10 %, suggesting few outliers in the MIPAS retrievals. Higher rejections can reflect problems with the model background or the observations, or may result from stricter quality control.'

pg 13524, line 8 after 'the UTLS.' add:

'However, the quality control system in ECMWF rejects a much higher percentage of MIPAS observations in the tropical lower stratosphere (14%) compared to BASCOE (1%), suggesting the ECMWF scheme may be more strict in this region.'

pg 13525, line 6 after '60-70S.' add:

'Both ECMWF and BASCOE rejected a high percentage of MIPAS observations in the lower stratosphere south polar region (38% and 29% respectively) and most likely reflects the poor quality of either the MIPAS observations or the model analyses in this region. The large analysis - observation biases in this region suggest the latter maybe important.'

pg 13530, line 1 after 'respectively.' add:

'A higher percentage of MIPAS observations were rejected in the USLM by the BASCOE system compared to ECMWF (Table 1). This is especially true in the southern hemisphere high latitudes and again may indicate the poor quality of the observations or analyses near the model top.'

pg 13526, line 26, remove:

' MIPAS observations entering....polar region'.

pg 13531, line 7 after '(not shown).' add:

'Over the intercomparison period, only approximately 4% of MIPAS observations in the

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lower stratosphere were rejected by the Met Office quality control scheme. However, in the USLM 37% of MIPAS observations were rejected, a much higher quantity than rejected by the other models, reflecting the model's poor background humidity field.'

5) Table 2 below will be added with the following text at the end of section 3.2:

'Table 2 summarises the relative biases found between the different satellite instruments'.

6) This paragraph has been modified following similar comments from the first referee. Please see comments 30-32 indicating how we propose to amend the text.

7) Indeed the problem of the dry BASCOE polar vortex relates to the inaccurate PSC scheme, which consequently leads to the MIPAS observations being rejected. The text in section 7 will be modified to better reflect this.

pg 13535 line 10-12 will be replaced by:

'BASCOE was found to have a particularly large dry bias in the Southern Hemisphere polar vortex and is most likely explained by an overactive PSC parametrization scheme. The MIPAS observations were only able to have a limited effect as many were rejected due to their deviation from the erroneously dry background field.'

	Pressure range	All latitudes	Tropics (-30:30)	South Polar region (-60:-90)
ECMWF	100hPa - 20hPa	11 %	14 %	38 %
	20hPa - 0.7hPa	1 %	0 %	2 %
BASCOE	100hPa - 20hPa	5 %	1 %	29 %
	20hPa - 0.1hPa	17 %	7 %	28 %

Table 1. The percentage of MIPAS observations rejected by each observational quality control system. No quality control has been applied in the MIMOSA system, consequently all MIPAS retrievals have been assimilated. Higher rejection rates occur for the Tropics and the South Polar region for at least one system, so these regions are shown separately. For other regions rejection rates are low, typically well below 10%.

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	HALOE	POAM III	SAGE II
MIPAS	Lower strat: MIPAS 5% wetter Upper strat and meso: MIPAS 10-20% wetter	Lower strat: MIPAS >15% drier Upper strat and meso: Good comparison	Lower strat: MIPAS 5% wetter Upper strat and meso: MIPAS >10% drier
HALOE		Lower strat: POAM III 5-10% wetter Upper strat: POAM III is wetter	Lower strat: HALOE is <10% wetter (except 15-20km) Upper strat and meso: SAGE II <20% wetter
POAM III			Lower strat: SAGE II 10% drier

Table 2. A summary of water vapour biases between MIPAS, HALOE, POAM III and SAGE II instruments in the stratosphere and lower mesosphere.

Interactive comment on Atmos. Chem. Phys. Discuss., 8, 13507, 2008.